Natural Gas Compressor Stations
Greenhouse Gas PSD Applicability Example
Sample Calculation Problems

Example 6. Modification - Hypothetical Natural Gas Compressor Station Scenario

Assumptions:

1. Existing facility with a potential to emit (PTE) less than 250 tons per year of a criteria pollutant.
2. Existing facility with a PTE for carbon dioxide equivalent (CO_2e) less than 100,000 tons per year.
3. The current PTE for greenhouse gas (GHGs) emissions on a mass basis is greater than 250 tons per year.

Proposed Project:

A company would like to add one (1) 800 brake horse power (bhp) natural gas compressor engine to their facility.

Given:

The proposed modification to the facility consists of adding the following emitting unit:

1. One (1) 800 brake horsepower (bhp) compressor engine

Other miscellaneous assumptions/information:

1. Compressor Engine Fuel Consumption = 8500 Btu/bhp-hr @ Maximum Design Capacity
2. Natural Gas Heat Value = 1020 Btu/scf

Example emission factors for criteria pollutants and GHG associated with the compressor engine is provided in the table below.

Table 1. Compressor Engine Emission Factors

Pollutant	Emission Factors	Units
Particulate Matter (PM_{10})	10	lb/MMscf
Sulfur Dioxide (SO_2)	0.002	g/bhp-hr
Nitrogen Dioxide (NO_x)	15	g/bhp-hr
Volatile Organic Compounds (VOC)	0.2	g/bhp-hr
Carbon Monoxide (CO)	1.4	g/bhp-hr
Carbon Dioxide (CO_2)	116.87	lb/MMscf
Methane (CH_4)	0.011014	lb/MMscf
Nitrous Oxide (N_2O)	0.000022	lb/MMscf

Problem Solving:

Problem #1. What are the potential emissions associated with the compressor engine?

Example Calculations:

Potential VOC emissions from the compressor engine are as follows:

VOC Emissions (Tons/yr) = (0.2 g/bhp-hr) * (800 bhp) * (1lb/454g) * (1 ton/2000 lb) * (8760 hr/yr) = 1.54 tons/yr * 25 engines = 38.5 tons/yr

Please calculate the potential NO_x emission for the compressor engine in tons/yr using the information provided above.

Table 2. Calculated Potential Emissions for the Compressor Engine

Potential Emissions in Tons/yr

	PM_{10}	**SO_2**	**NO_x**	**VOC**	**CO**	**CO_2**	**CH_4**	**N_2O**
Compressor Engine	0.26	0.02	115.87	1.54	13.90	3,480	0.328	0.00066
Total =	**0.26**	**0.02**	**115.87**	**1.54**	**13.90**	**3,480**	**0.328**	**0.00066**

Problem #2. In terms of mass, what are the total emissions from GHGs?

Total Emissions of GHGs in tons/yr = CO_2 + CH_4 + N_2O (Refer to Table 3.)

3,480 tons/yr + 0.328 tons/yr + 0.00066 tons/yr = _____ tons/yr

Problem #3. What are the total emissions of CO_2 equivalent (CO_2e)?

Step 1. In order to determine CO_2e, Refer to Table A-1 of CFR Title 40, Part 98, Subpart A, for the Global Warming Potentials (GWP).

Step 2. Indentify the GHG pollutants (e.g., CO_2, CH_4, and N_2O) and their Global Warming Potentials (GWPs) as shown below.

Pollutant	**Global Warming Potential (GWP)**
CO_2	1
CH_4	21
N_2O	310

Step 3. Calculate CO_2e using the following equation:

CO_2e (tons/yr) = ∑ (Mass Emission Rate (tons/yr) * GWP)

CO_2e (tons/yr) = (3,480 tons/yr*1) + (0.328 tons/yr*21) + (0.00066 tons/yr*310) = _____ tons/yr

CO_2e (tons/yr) = 3,487 tons/yr

Summary GHG and CO_2e Emissions:

GHGs (Mass)	CO_2e
3,480 tons/yr	3,487 tons/yr

PSD Applicability Summary Analysis:

Question #1: Does this permit action result in a net increase of any criteria pollutant above PSD significant emission rates (SER)?

Question #2: Does this permit action have GHG emissions above the PSD threshold on a mass basis(> 250 tons/yr)?

Question #3: Does this permit action have CO_2e emissions above the PSD threshold?

If the answer to Questions #2 and #3 are both "Yes", than GHGs must undergo a PSD review based on the following.

1. If the permit department decision occurs before January 2, 2011, GHGs are not required to be addressed in the PSD review.

2. If the permit department decision occurs between January 2, 2011 and July 1, 2010, GHGs do NOT need to be included in the PSD review even if any criteria pollutant is above significant levels. (Note:

3. If the permit department decision occurs on or after July 1, 2011, GHGs must be included in the PSD review along with any criteria pollutants above significant levels.

Title V Applicability Analysis/Overview:

Question #1: Is the facility an existing Title V facility?

Question #2: Are the potential emissions of GHGs greater than 100 tons per year?

Question #3: Are the potential emissions as CO_2e greater than 100,000 tons per year?

If the answer to Questions #1, #2, and #3 is "Yes", a Title V permit action to address GHGs are described in the following scenarios.

- A department decision occurring before January 2, 2011, would not require GHGs to be addressed in the Title V permit.
- A department decision occurring after January 2, 2011, must address GHGs in the Title V permit.
- A department decision occurring after July 1, 2011, must address GHGs in the Title V permit.

If the answer to Questions #2 and #3 is "Yes", a Title V permit action to address GHGs are shown as follows:

- A department decision occurring before January 2, 2011, would not require GHGs to be addressed in the Title V permit.
- A department decision occurring after January 2, 2011, would not require GHGs to be addressed in the Title V permit.
- A department decision occurring after July 1, 2011, would require GHGs to be addressed in the Title V permit.